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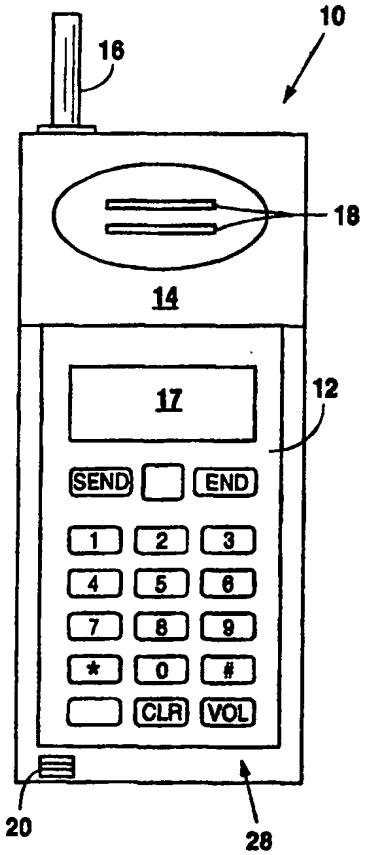
(54) Title: TELECOMMUNICATION APPARATUS HAVING DUAL KEYPADS

(57) Abstract

Dual keypads are provided on alternate sides of a flip cover (12) that is pivotally attached to the housing (14) of a telecommunications instrument, such as a cellular telephone. One of the keypads is operable when the cover is in a closed position, and the other keypad operable when the cover is in an open position.



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TELECOMMUNICATION APPARATUS HAVING DUAL KEYPADS

BACKGROUND OF THE INVENTION

Technical Field

This invention relates generally to portable telecommunication instruments, and more particularly to a dual keypad arrangement for such instruments.

History of Related Art

Manually operable keypads are commonly used in telecommunication instruments such as cellular telephones and radios, personal-digital assistants (PDA) personal organizers and cellular phone combinations, and similar transmitting and receiving instruments. In many applications, it is desirable to have a large number of keys to provide a wide variety of separate input signals. For example, in many applications it is desirable to have a full English alphabet character input requiring 26 keys, and additional keys for punctuation marks. If the telecommunication instrument is adapted for the Japanese market, about 60 keys are required for Japanese Kanji characters. The increasing need for additional keys requires additional space on the instrument for the keypad array. However, it is desirable to keep the instrument as small as possible so that it can easily be held in the hand, or even carried in a pocket, of the user.

The present invention is directed to overcoming the above problems. It is desirable to have a telecommunication instrument that provides for many more keyed input signals than is available with the single keypad commonly used on cellular phones and the like. It is also desirable to have a telecommunication instrument that provides for additional keyed input signals without increasing the overall size of the instrument.

SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention, a telecommunication instrument comprises a housing and a cover pivotally attached to the housing. The cover is movable between a closed position at which the cover overlays a predefined portion of the housing and an open position at which the cover is spaced from the predefined portion of the housing. The cover also includes a first keypad disposed on the first surface of the cover that is operable only when the cover is in the closed position, and a second keypad disposed on a second surface of the cover that is operable only when the cover is in the open position.

Other features of the telecommunication instrument embodying the present invention include at least one of the first and second keypads being a substantially flat membrane keypad having a plurality of separately defined touch sensitive areas disposed on the keypad. Other features include at least one of the first and second keypad being a plurality of touch sensitive keys, each of which provide tactile feedback to an operator of the keypad. Still other features of the telecommunication instrument embodying the present invention include the instrument having a means for sensing the respective open and closed positions of the cover.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the structure and operation of the present invention may be had by reference to the following detailed description when taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a plan view of a telecommunication instrument embodying the present invention, showing the pivotable cover in a closed position;

Fig. 2 is a plan view of the telecommunication instrument embodying the present invention, showing the pivotable cover in an open position;

Fig. 3 is a plan view of the telecommunication instrument embodying the present invention, showing an alternative attachment arrangement of the pivotable cover which is shown in an open position;

Fig. 4 is a schematic diagram showing a keypad switch matrix circuit of the telecommunication instrument embodying the present invention;

Fig. 5 is a schematic representation of a mechanically operable switch arrangement for providing a signal indicating the position of the cover;

Fig. 6 is a schematic representation of an alternative arrangement of a switch for providing a signal indicating the position of the cover; and

Fig. 7 is a schematic cross-sectional representation of the cover and housing showing a flexible cable connection between the two members.

DETAILED DESCRIPTION OF A PRESENTLY PREFERRED EXEMPLARY EMBODIMENT

A telecommunication instrument embodying the present invention is illustrated herein as a cellular telephone **10** having a movable cover **12** that is pivotably attached to a housing **14** comprising the main body of the instrument. The main body, or housing, **14** of the cellular telephone **10** typically provides support for an antenna **16** and an enclosure for electronic circuitry providing the signal processing required for operation of the instrument **10**. Typically, the circuitry includes both RF signal processing circuits and keyboard logic decoding circuits. In the present invention for reasons described below in more detail,, the instrument **10** includes either two conventional logic decoding circuits, or a single circuit capable of operating in two modes, that is responsive to

a signal representative of the open or closed position of the cover **12**. In the illustrative embodiment, the cellular telephone **10** includes an LCD display screen **17** adapted to display received data and, in some applications, transmit data entered directly onto the screen **17**. The housing **14** also has an opening **18** to provide transmission of audible signals from an internal speaker to a user, and openings **20** to provide transmission of audible signals from a user to an internal microphone.

In the preferred embodiment of the present invention, the flip cover **12** is pivotally attached to the housing **14** by hinges **22** disposed at one side of the cover **12** as shown in Fig. 2, or at the bottom of the cover as shown in Fig. 3. Typically, the housing **14** and the frame of the cover **12** are injection molded of a thermoplastic or thermoset plastic material such as ABS resins, cellulosic plastics, phenolic resins, phenylene oxide resins, polycarbonate, polyester, polystyrene, polyurethane, or polyvinyl chloride. The hinges **22** are thus integrally molded with the respective housing **14** and cover **12**, and subsequently assembled by inserting a pin through both halves of the hinge or by the snap fit of one hinge with a mating portion of the other hinge. Desirably, the cover **12** also includes an opening **26**, aligned with the slots **20** in the housing **14** when the cover **12** is closed, to provide for voice transmission to the microphone disposed in the housing **14**. In the side opening arrangement shown in Fig. 2, the cover 12 also includes an opening **24** to provide visual observation of data displayed in a predesignated area of the LCD screen **17**.

Importantly, the cover **12** contains two keypads. A first keypad **28** is disposed on an outer surface of the cover **12** when the cover is closed, and a second keypad **30** is disposed on the inner surface of the cover **12**. In the preferred embodiment, the first keypad **28** is desirably formed of a plurality of touch-responsive keys, each of which provide a tactile feedback to the operator of the

keypad. Keypads of this type are typically formed of silicone rubber with a conductive carbon pill attached to the bottom surface of each key. The conductive carbon element provides a switch that closes a circuit across a pair of contacts provided on an underlying printed circuit board **32**.

In the preferred embodiment of the present invention, the second keypad **30** is a substantially flat membrane keypad having a plurality of separately defined touch sensitive areas. Keypads of this type are commonly used on thin "credit card" calculators and other keypad operated instruments that require a thin overall thickness. Thin membrane keypads typically have a flexible membrane cover which is imprinted with a plurality of characters. Under each of the characters, a thin conductor is shaped to span two contacts on an underlying printed circuit board. Depressing the membrane in the area of a particular character causes the underlying electrical conductor to complete a circuit across the associated contacts. In the illustrated embodiment, 60 separate areas are provided on the second keypad **30**. The 60 areas are thus capable of providing a full English alphabet arrangement and associated punctuation characters, in addition to numeric characters 0-9 and additional function keys. If desired, the 60 character display may be imprinted with Japanese Kanji characters, or other language characters. Typically, the membrane keypad does not provide a tactile feedback to the user, but generates a beeping sound when a specific key is depressed, thus providing an audible feedback signal. The thin membrane keypad is particularly suitable for operation on the inside surface of the cover **12** due to its substantially flat surface topography. A sectional view of the first and second keypads **28, 30** is shown, in somewhat schematic fashion, in Fig. 7.

Fig. 4 shows a diagram of the electrical circuit **34** associated with each of the keypads **28, 30**. The lower

area enclosed by dashed lines in Fig. 4 represents the portion of the electrical circuit supporting the first keypad **28** and the upper area enclosed by dashed lines represents the electrical circuit supporting the second keypad **30**. The electrical circuit is essentially an 8 x 8 matrix circuit (rows 1-8 and columns a-h) providing 64 switch contacts for the second keypad **30**, although only 60 keys are actually used in the illustrative embodiment. It is desirable to provide separate input circuits for the first and second keypads **28,30** to avoid signal interference resulting from the accidental actuation of a key on the first keypad **28** when using the second keypad **30**. When using the second keypad **30**, the first keypad **28** becomes the back cover and could be inadvertently pressed during use of the second keypad **30**.

A separate switch on the printed circuit board **32** senses whether the cover **12** is in the open or closed position and, accordingly, which decoding logic circuit should be activated. In Fig. 5, the cover position switch is a simple mechanical switch **36** that is depressed by a tab **37** extending downwardly from the cover **12**. The mechanically operative switch **36** is moved from a normally open position to a closed position in response to the cover **12** being moved from the open to the closed position. The switch **36** is thus activated when the cover **12** is in the closed position.

Alternatively, the cover position switch may comprise a reed switch **38** that is activated by a magnet **40** disposed in an aligned portion of the cover **12**, as shown in Fig. 6. The reed switch **38** remains closed in the presence of the magnet **40**, and is opened by movement of the cover **12** away from the closed position. Thus, the switches **36, 38** alternatively provide a means for sensing the respective open and closed position of the cover **12** and providing a signal to the logic decoding circuitry of the cellular phone **10** representative of the position of the cover **12**.

Desirably, the first keypad **28** may also include a plurality of light-emitting diodes (LEDs) **42**, arranged under the first keypad **28** as shown in Fig. 7, to provide illumination of the keypad **28** under low light conditions. If desired, the membrane keypad may also be backlit by using the same LEDs **42** that provide illumination of the keys of the front, or first, keypad **30**. This portion of the circuitry is also shown in the lower area enclosed by dashed lines in Fig. 4.

Communication of electrical signals between the first and second keypads **28, 30** disposed on the cover **12** and the keyboard logic circuitry of the phone **10** is provided by a flexible flat cable **44** having 21 leads disposed, typically in side-by-side relationship, within the cable **44**. Two of the leads provide illumination of the LEDs **42**, eight of the leads are connected to the columnar portion of the matrix circuit, represented by letters a-h in Fig. 4, and the remaining eleven leads are connected to rows 1-11 arrayed along the other axis of the matrix circuit in Fig. 4.

Thus, it can be seen that the cellular phone **10** embodying the present invention provides a telecommunication instrument having many additional keys, and alternate modes of operation, than provided by conventional single keyboard cellular telephones. Advantageously, the cellular telephone **10** does not require any significantly increased volumetric size than conventional cellular phones, and provides a convenient flip cover function, which many users find desirable as an extension of the telephone.

Although the present invention is described in terms of preferred exemplary embodiments, with specific illustrative construction and circuit arrangements, those skilled in the art will recognize that changes in those arrangements and constructions may be made without departing from the spirit of the invention. For example, the pivotally attached cover **12** may be constructed so that

it is detachable from the housing **10** and the flexible cable **44** provided with connectors that enable the second keyboard **30** to be operated at a position remote from the housing **14** of the cellular phone **10**. Such changes are intended to fall within the scope of the following claims. Other aspects, features and advantages of the present invention may be obtained from a study of this disclosure and the drawings, along with the appended claims.

WHAT IS CLAIMED IS:

1. A telecommunication instrument, comprising:

a housing;

a cover pivotably attached to said housing and movable between a closed position at which said cover overlays a predefined portion of said housing and an open position at which said cover is spaced from said predefined portion of the housing, said cover having a first keypad disposed on a first surface of said cover and operable only when said cover is in the closed position and a second keypad disposed on a second surface of said cover and operable only when said cover is in the open position.

2. A telecommunication instrument, as set forth in Claim 1, wherein at least one of said first and second keypads comprises a substantially flat membrane keypad having a plurality of separately defined touch-sensitive areas disposed thereon..

3. A telecommunication instrument, as set forth in Claim 1, wherein at least one of said first and second keypads comprises a plurality of touch-responsive keys providing tactile feedback to an operator of said keypad.

4. A telecommunication instrument, as set forth in Claim 1, wherein said first keypad comprises a plurality of touch-responsive keys providing tactile feedback to an operator of said first keypad, and said second keypad comprises a substantially flat membrane keypad having a plurality of separately defined touch-sensitive areas disposed thereon.

5. A telecommunication instrument, as set forth in Claim 4, wherein said cover includes a plurality of light emitting diodes disposed under said first keypad and

arranged to provide illumination of the keys comprising said first keypad.

6. A telecommunication instrument, as set forth in Claim 1, wherein said instrument includes a means for sensing the respective open and closed positions of said cover.

7. A telecommunication instrument, as set forth in Claim 6, wherein said means for sensing the respective open and closed positions of said cover includes a mechanically operative switch that is moved from a normally open position to a closed position in response to said cover being moved from the open to the closed position and is maintained at said closed position in response to said cover being disposed at said closed position.

8. A telecommunication instrument, as set forth in Claim 6, wherein said means for sensing the respective open and closed positions of said cover includes a magnetic material disposed at a predetermined position on said cover and a magnetically operative switch disposed in said housing at a position aligned with the magnetic material in said cover when said cover is in the closed position.

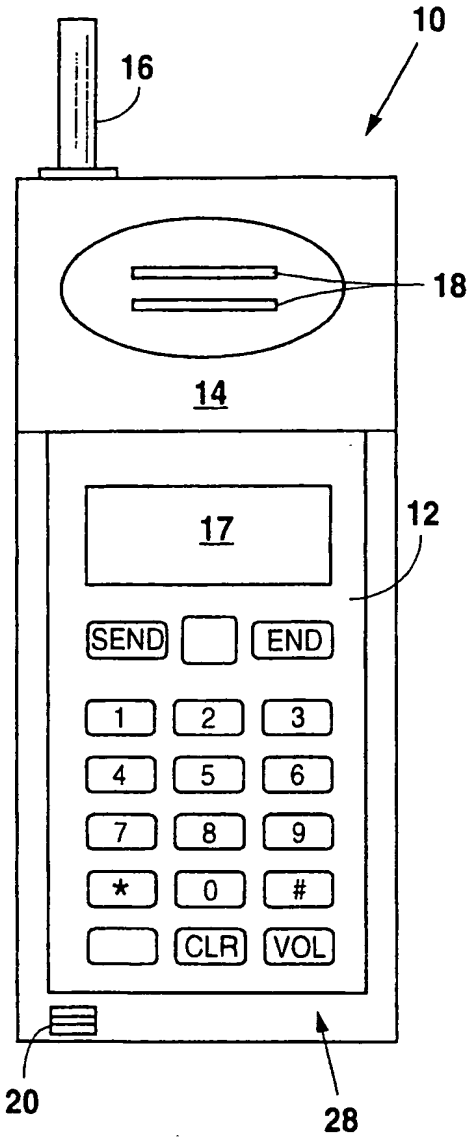
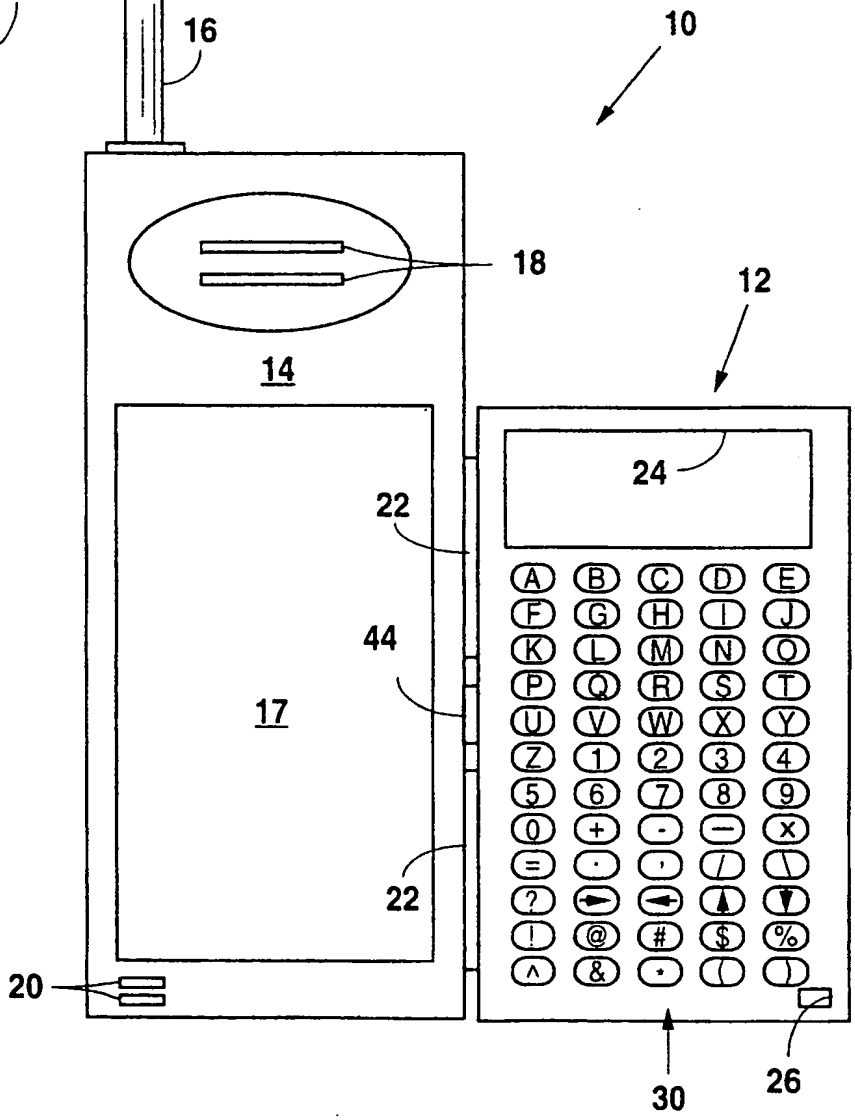

10
16
18
14
17
12
SEND
END
1
2
3
4
5
6
7
8
9
*
0
#
CLR
VOL
20
28

Fig. 1


16
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18
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30
26

Fig. 2

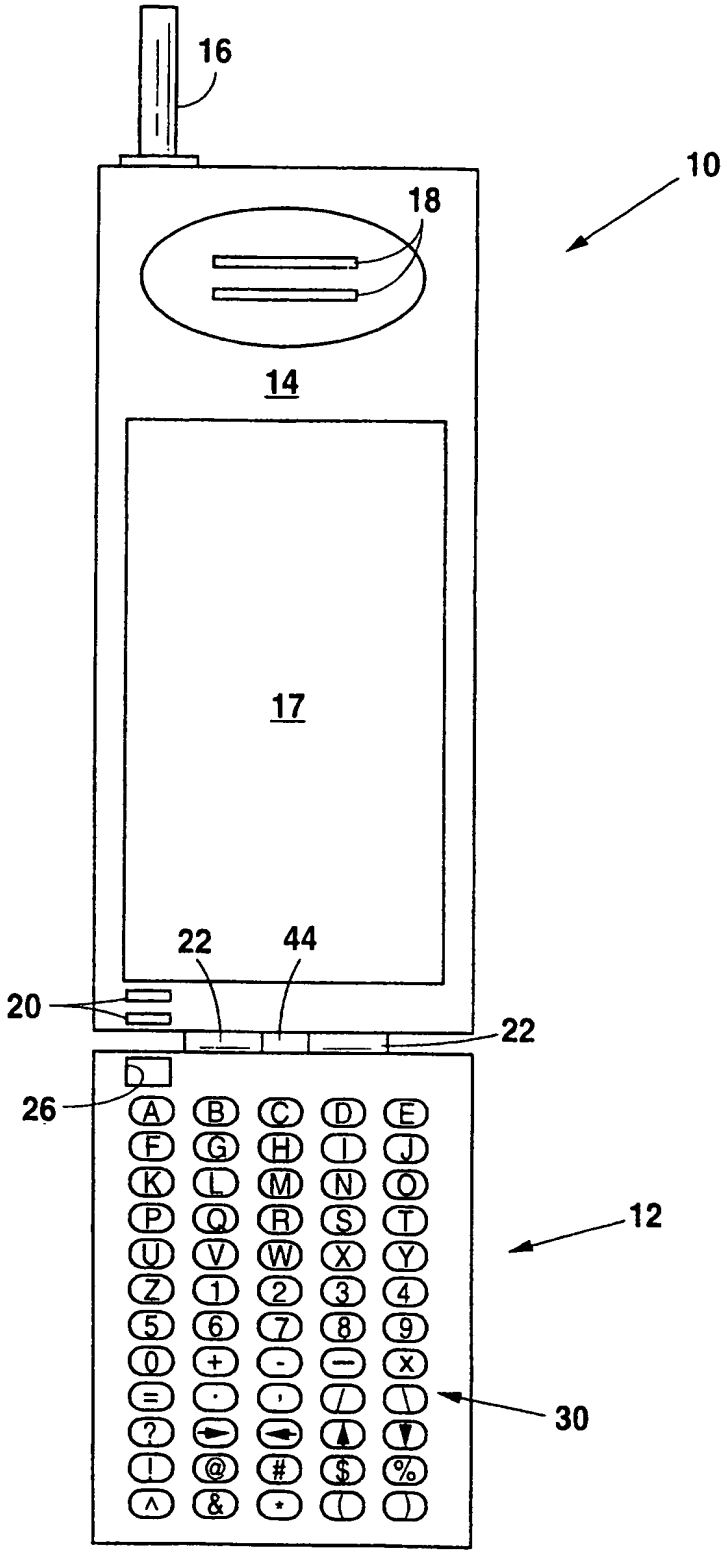
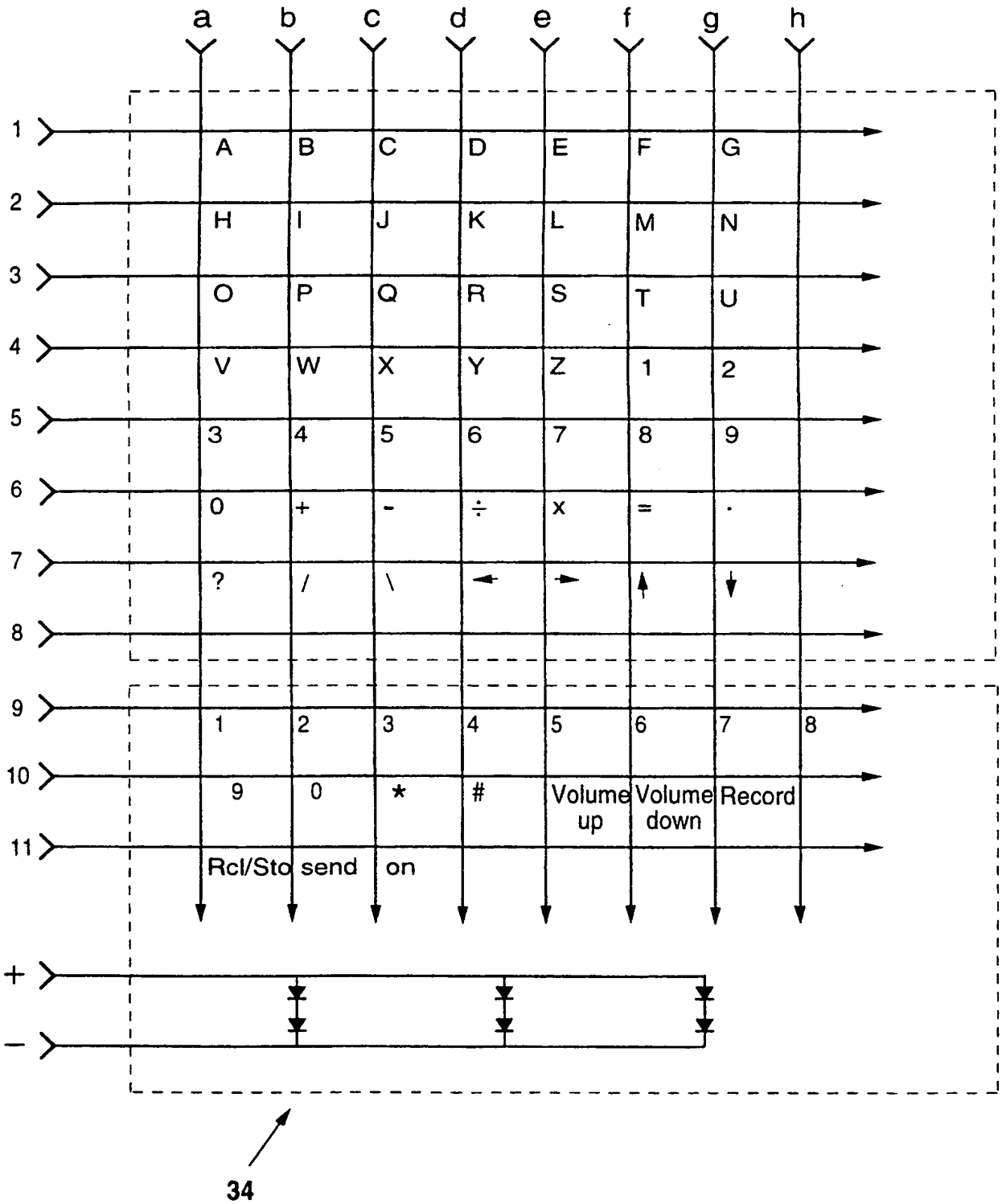


Fig. 3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1 A B C D E F G
2 H I J K L M N
3 O P Q R S T U
4 V W X Y Z 1 2
5 3 4 5 6 7 8 9
6 0 + - ÷ x = .
7 ? / \ ← → ↑ ↓
8
9 1 2 3 4 5 6 7 8
10 9 0 * # Volume up Volume down Record
11 Rcl/Sto send on
+
–
34

Fig. 4

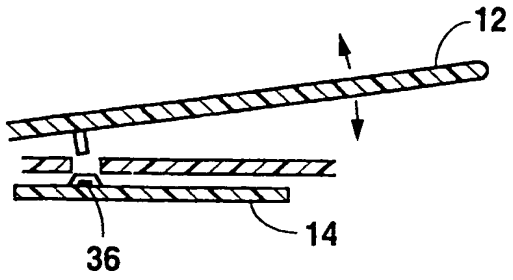

Fig. 5

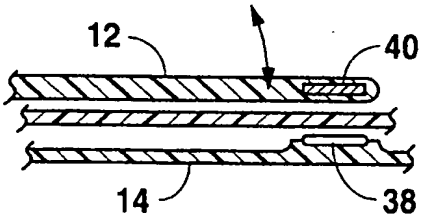

Fig. 6

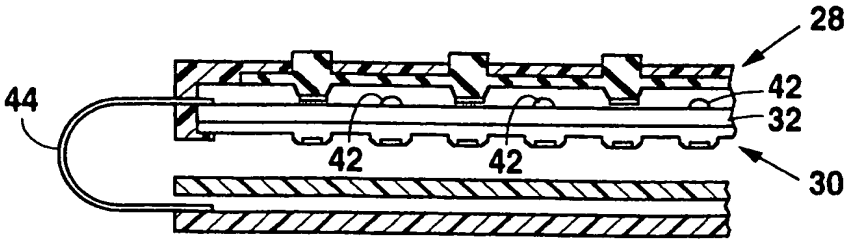

Fig. 7

INTERNATIONAL SEARCH REPORT

I. ıational Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04M1/02

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 534 478 A (CASIO COMPUTER CO LTD) 31 March 1993 see column 3, line 1 - column 4, line 22 see column 11, line 29 - column 12, line 36 see figures 1,3,4,9	1,6,7
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
28 January 1998	05/02/1998

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

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